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Address on Oils by Major H G L Strange,
and Reporting Re: Order In Council 1

MEETING OF AGRICULTURE COMMITTEE

at Buildings, 10 a.m. March 14, 1930.

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Address on Oils by Major H. G. L. Strange, and reporting
re Order-in-Council No. 980-29 of September 6, 1929.

MAJOR STRANGE:

An Order-in-Council was signed by the Lieutenant Governor
on Friday, September 6, 1929, as follows:

"WHEREAS the following Resolution of the Legislative
Assembly was passed on the 14th day of March, 1929.

"RESOLVED, That the Government should conduct an inquiry
into the question of the desirability of establishing by
law, standards and grades for all fuel oils and lubricat-
ing oils used in internal combustion engines; and that the
Government report the result of such inquiry to the next
session of this Assembly"

AND WHEREAS it is expedient that a Committee be appointed to
make such inquiry;

THEREFORE the Executive Council advises that the undermentioned
persons be, and they are hereby appointed a Committee to in-
quire into the said question, and submit the result of such
inquiry to the Government, to be reported to the Legislature
at the next session:

Major H. G. L. Strange, Fenndale Farm, Fenn, Alberta.

Edgar Stansfield, M.Sc. of the Research Council,
University of Alberta.

James Fowler, M.A., Institute of Technology, Calgary.
Instructor in Science and Mathematics.

The Committee met very soon after that and made an en-
deavor to appraise the situation. We tried to find out what
it was all about and what we were expected to find out and the
reason for the resolution. We came to the conclusion that a
good deal of money perhaps was being wasted by farmers and
owners of automobiles in using wrong oils, or inferior oils,
or oils adulterated, or oils that had been substituted. We
therefore outlined a plan of work and divided it amongst the
three members of the committee, but after we had gone a certain
distance with that plan we felt it desirable to call a meeting
with the National Research Council and the Dominion Government
who had done a certain amount of work in previous years along
this line. These people were kind enough to meet us in Edmonton
and Mr. Reid, the Provincial Treasurer, was with us. These
people offered the utmost assistance and help to the Committee
and our plan was slightly modified so in the event of anything
being done finally it would not only be of provincial importance
and value but also of national value, and in such a manner all
other provinces and the Dominion could take it up.

There is keen interest in Alberta and other provinces and
with the Dominion Government in this matter of standardizing oils.
It is the fashion in Canada to standardize almost everything the
farmer produces and sells with the exception of oils. Such a
trivial thing as Flytox is standardized and graded and comes
under the inspection of the Dominion Government, but lubricating
oils, and fuel oils, are curiously not standardized but a lot of
attempts have been made to standardize and grade these important
products.

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A faint, light-colored watermark of the Alberta Legislature building is visible in the background. The building is a large, classical-style structure with a prominent central tower and multiple wings. The watermark is semi-transparent, allowing the text in the foreground to be read.

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The exact plan of work, after meeting with the Research Council and the Dominion Government was: Collection and analysis of samples from manufacturers. Collection and analysis of samples from ultimate purchasers. Collection and analysis of samples from retailers and distributors between manufacturers and purchasers, to determine whether there has been any substitution or adulteration in between.

The Provincial Laboratory agreed to collect 10% of the samples, which is the usual engineering check and the Department of Mines agreed to conduct an investigation, not as full, but along parallel lines, so you can see when all this is done we shall know whether or not it is accurate.

Another phase is the collection of specific data information and standards from all foreign countries, engineering and mining associations, private companies, oil companies, tractor companies and from individuals, comprising everything that is known up to the moment, the work that has been done along these lines; standards adopted, if any, by any country.

We undertook the compilation of the results of a questionnaire sent out to the U.F.A. Locals, asking the names of oils and brands used in their districts, prices, experience and suggestions. Apparently we have unearthed an exceedingly valuable use for the locals of the U.F.A. A great many of the answers are not only highly intelligent but exceedingly valuable.

Then we adopted the plan of making some running tests in tractors under controlled conditions at the School of Technology to determine the amount of dilution, amount of wear on pistons, cylinders and rings, and amount of disappearance of oil, and if possible some relative values, and then to check up running tests with actual controlled tests in the farmers fields performing the actual work.

After that there was the preparation of the preliminary report and the preparing of an estimate for further work as has been handed in to the Government.

This matter divides itself into two parts; fuel oil, - gasoline, kerosene and distillate, and then we have lubricating oils, two different kinds of products but both of them manufactured from crude petroleum or crude oil, and it might serve my purpose if I briefly outline something about this product, crude petroleum. I might say first, oils of this kind used to be made from whale oil, which is a good lubricant; also Castor Oil which is one of the best lubricants. During the war, for instance, the aeroplanes used mainly castor oil, the same material as you feed children when they are sick.

Crude petroleum is a very complex mixture of hydrogen and carbon, called hydrocarbon, and there is a difference in the percentage of hydrogen and carbon in the different oil fields in the different parts of the world. If you take a test tube, which in a chemical laboratory is a glass tube made of heat-resisting glass, an inch in diameter, with one end closed and one end open, and take that up and put crude oil in and apply a flame underneath it begins to boil, and vapours arise, depending on the amount of heat applied, until all the oil is gone from the tube. Distillation temperatures vary from 100° Fah, to 700° Fah. When the last one has come off it is arbitrarily split up into what is called 'fractions', which have been given names quite arbitrarily, but they are still mixtures of hydrogen and carbon. First there are the volatile hydro-carbons without much value because they are impossible to hold, then comes the water at 212° which will vaporize off. If in addition to the tube you

make a condenser you can accurately measure the percentage of each one coming off, which is a most interesting experiment to anyone interested in the distillation of oil.

After that we get benzine, the material you buy to clean clothes with. Then comes naphthas, practically the same naphtha as is squeezed out of gas at 72 Beaume, which is an easy naming method to present the specific gravity, instead of getting into a lot of figures for specific gravity. If you use the Beaume scale for oils and naphtha around 72° you will get exactly what is squeezed out of the Turner Valley gas.

Then comes gasoline around 60 to 62 Beaume. Kerosene is around 48. These are the fractions you use to burn in your car or tractor to get explosion to give power.

From the same oil comes light lubricating oils usually used for machine oils and for marine steam engines. Then we get heavy lubricating oil, much more heat resistant. These oils are used in combustible engines. Then we get parafine, asphalt, and naphthalene.

Gasoline used to be gained from crude oil in the method I have indicated and before 1911, 5% of the total crude oil was gasoline, then automobiles came, so scientific research and effort were put on to this method of distillation, and great improvements took place by which lower fractions could be split up and recombined into lighter oils or gasoline, so by 1911, 11% could be made into gasoline. By 1925, 26% of the total crude oil could be made into gasoline and if it had not been for these great advances in science gasoline would have been 75 cents a gallon or 80 cents to-day. Since 1925 great advances have been made and it is the hope of petroleum engineers that perhaps 75 to 80% may in time be turned into gasoline. It differs somewhat in the crude oils available in different parts of the world. This new process is called the 'cracking process', which is really a distillation process done in a scientific manner under high pressure and they are able to recombine hydrogen and carbon and get it into gasoline from the heavier oils. From one produce, crude oil, there is made gasoline, kerosene and lubricating oils used to lubricate steam engines and particularly internal combustion engines.

Gasoline has varied from time to time very much. Gasoline used to be 76 Beaume before 1911 and to-day it is only 60°. It has come down in the scale of things. It is probable the ultimate buyer has not lost anything by this because carburetors have been so improved that they will burn 60 to 62° gasoline where they used to burn 76°.

In all the fractions of crude oil I have mentioned there is about the same heating value per gallon, so if you efficiently burn crude oil itself you get the same value as if you burn Turner Valley naphtha which is the most volatile product to-day capable of being used.

In this distillation process the temperature at which gasoline used to be taken was 230° and is now 440° going lower in the scale, but it makes no difference provided the gasoline is of such a nature as you can use this product provided the engineers devise a process of properly burning it so there will be no loss.

I am endeavoring to show the importance of the discovery of Crude Oil in Alberta and to show the reason for the frantic endeavors being made to-day. With the exception of naphtha all crude oil and gasoline is made from crude oil, and with the expensive freight, the discovery of crude oil in this country would

be of tremendous benefit to all citizens if ways and means can be devised of getting the saving in price back to the consumer.

In the attempts to investigate fuel oil, gasoline and kerosene, also distillates, the Committee found the problem is comparatively simple for the reason the Department of Mines made an exhaustive survey of gasoline brands and gasoline and kerosene are pretty well standardized by all companies putting them out. The qualities are fairly well known, and what they have to do is well known, and there is very little dissatisfaction with them. These surveys are being conducted as well as the surveys this particular committee is accomplishing. The Department of Mines had never made a gasoline survey but they are now making one and probably will continue that year after year, so a lot of material is available to us.

The exact qualities of gasoline and kerosene while gradually being standardized by the manufacturers have never been legally defined by law, that is to say if one went to law on this matter you would have a hard job to persuade a Judge there was such a thing as gasoline or kerosene as the range is a very arbitrary one. It used to be 72° now it is 60° and two or three years from now it may be down to 50°, and the only difference between gasoline and kerosene is in that quality the viscosity.

The only complaints we received through the questionnaire was about water. Now the process of manufacture is such that it is impossible for water to be in kerosene and gasoline. Your committee believes when gasoline or kerosene is turned out from the manufacturer's factory that they certainly contain no water, but the complaints about water are so general that apparently water gets into the gasoline and kerosene and the committee investigated the methods by which water could get in.

One is the ordinary method of a farmer purchasing gasoline and kerosene to have a number of drums on his farm and the oil man comes out with the tank wagon and the drums are filled. The drums have a raised edge with a hole in the top into which fits a plug and very often it is found that the top of the hole is lower than the surrounding edge. If the barrel is left out in the rain it is possible for a lot of rain to run into the barrel, and if in a hurry the tank driver puts in the hose and the gas is put in on top of the water.

Another method is, some farmers use oil barrels for carrying water on stone boats and again perhaps the barrel is not emptied and it only takes a drop or two to get into the mixtures of an internal combustion engine to cause loss of time. The Committee thought of asking the Oil Companies to have a standard method of filling barrels so it would be wrong for him to fill a barrel without first turning the barrel upside down and see that it is empty of water.

An unscrupulous driver might leave with a full tank of oil and after he had sold a little, pour five or ten gallons of water in his tank hoping in the shaking of the tank wagon that the whole would become mixed and no one know the difference. We have found no cases of that but the committee is looking into it as it could occur.

Suggestions have been made that we might eventually test out the value of Turner Valley Naphtha for use in its unrefined state as is comes from the wells with a view to either purchase from the wells or of co-operative groups drilling their own wells. We are not undertaking that. These are simply some things that came up for discussion.

Because gasoline and kerosene required expensive plants only large and reputable companies engage in the manufacture and therefore the consumer of gasoline and kerosene has a good deal of protection in the way of companies with which he is dealing. This is in great contrast to the matter of lubricating oils because smaller firms can manufacture lubricating oils and some people have set about the business of making up alleged lubricating oils in the back of their garage and retailing at a large profit.

The point is there is great differences between fuel oils and lubricating oils.

There are exact tests we are conducting in the laboratory. We are testing for specific gravity, distillation range and initial boiling point, 5% then 10% off and up to 95% then the end point. We are testing residue and testing for sulphur. Sulphur is an important thing in fuel oils.

Distillate is the fraction underneath kerosene. We are testing for specific gravity, flash point, distillation range, and again for sulphur. That is about all I have to say about fuel oils. The problems there are comparatively simple as compared with lubricating oils.

Lubricating oils are a real problem with which the committee has to deal. This is an important thing to remember that the committee right at the start was forced to appreciate the fact that the science of lubrication under high temperature conditions, such as exist within the walls of internal combustion engines is not as thoroughly understood as is generally supposed. It therefore follows that the exact character or qualities desirable in a lubricating oil for such duty cannot be definitely specified, so that such oils, as yet, are difficult of satisfactory standardization. I think that is a very important thing to remember because it is not usually understood. In the questionnaires that came back from the Locals with one exception they were in favor of this enquiry but one man said it was a waste of public money; that all that had to be done was for the Government to send an inspector to stamp on every oil can and everybody would know about it without the committee working.

The act of lubrication is not understood and therefore how can one define exactly the qualities in oil, when you do not know exactly what the oil is to do. The Committee also found that a large number of people manufactured lubricating oils and perhaps alleged lubricating oils, and apparently itinerant salesmen were selling oils to farmers on small samples and this is perhaps more generally practised than is believed. At certain times of the year the salesman comes around with small samples of oil. He asks the farmer what he is paying for oil and offers to supply him at considerably less and says "Here is a sample, have it tested". The sample always is good as far as tests can be applied but whether it is the oil finally delivered is a question. We have had stories of a great deal of harm being done by this kind of oil.

I spoke to a high official of one of the largest oil companies who runs a farm on the side and he told me the manager of his own farm endeavored to save money by purchasing oil from one of these salesmen, but he had to have his tractor repaired. I suggest this; if an important official does himself lose money in this fashion there is no reason to suppose that a number of farmers are not losing money in the same way.

It is exceedingly difficult to standardize with the present knowledge and it is difficult to imagine a state of grades or

standards that will take in all reputable oils and shut out the poor oils. If it is made wide enough to take in the good oils it will take in the poor. Who is going to define which is good and which is poor? One recommendation is deal with a reputable oil company which has a reputation to maintain. With the present lack of knowledge one should not deal with representatives of organizations of which nothing is known.

One test we made was for viscosity, for Flash and Fire Point, Pour Point and Carbon Residue. If you take a sheet of plate glass and hold it at a slant, then pour water on it and it will run away quickly, but pour Olive oil on it and it will run off more slowly, or molasses which will be slower still. That is viscosity. It is resistance to flow which has an effect on the use of oil. Viscosity is measured by having a tube of known size of hole and length and determining the number of seconds a certain amount of oil takes to run through that tube in proportion to its thickness. Thickness is not a good term but it brings to mind this quality.

I may say generally there is no countries and no States that have attempted to standardize qualities of oil, but a lot of people have been working on it and this enquiry being made to-day by you, if carried through as recommended is probably the most complete enquiry ever made for this whole matter. That may be a strange thing to say and you may say why was it not done before. There is a reason. Up to almost yesterday when internal combustion engines the automobile and the tractor came in the only people using engines were professional engineers who always bought on specification. They did know when this oil, in accordance with certain tests behaved well. They understood their wants and the conditions they must avoid, so there was really no need for standardization of oil up until the amateur buyer came into the field; the owner of the automobile, the owner and operator of the tractor, and that of course happened only comparatively yesterday and these attempts at standardization, and the enquiry into them, have been as a means of protecting the innocent purchaser.

Some States in the United States have adopted what they call Anti-Substitution Laws. They say while we do not know anything about the quality of oils we are going to pass laws that when a man asks for a certain make or brand that legally he cannot be given anything else, and all packages must be plainly marked. You can go to any Oil Service Station and see a large number of bottles bearing prices from \$2.00 to 50 cents per gallon. You may ask for the \$2.00 oil but there is nothing to the eye to tell you whether you are getting it or not because colour and thickness can be duplicated. That is one form of protection put in in many States of the Union. The Committee do not raise this as certain objections were raised, one being that it would require an army of inspectors to enforce such a law. Another line of thought was that may be substitution being against the law, the instant it becomes illegal there would be an effect on a percentage at least who will not do an illegal thing, and you are having a moral effect on a certain percentage of the sellers. That is a matter for very keen thought and very keen debate. As I said before in the tests in the laboratories we have with us the provinces and the Dominion and we have the fullest co-operation and assistance of the oil companies who are just as interested as this Government in attempting to devise standards if it can be done.

What is lubrication? That is the first thing the committee was faced with. This fundamental fact is known that some oil must roll the bearing. If you have two metal surfaces revolving one over another and you put nothing between they will seize and the whole thing will be ruined. Some film has to go in between

them. Water is not a bad lubricant. There are instances of large turbines running with certain free bearings with water as a lubricant but that is where a little film of water is able to be retained. The trouble with water is that as soon as heat is applied it evaporates. Kerosene is not bad and if run in a bath of kerosene there is a perfect lubricant. Exactly what is lubrication? Actually nobody knows other than there has got to be some film between two metal surfaces, otherwise they will seize.

In these products which we call lubricating oils there are two factors involved; one is the factor of quality and the other the factor of fit. We might make an analogy in speaking of a man purchasing a shirt. The first thing he asks for is the size; that is, the fit, and so we have in oil the fit of oil, but that has nothing to do with quality. You might buy a 50 cent cotton shirt or a \$5.00 silk shirt. The same with oil, the quality of oil whether it will wear longer or less time is a different factor altogether to the fitness, and in as much as you can get a reasonable amount of wear from a cheap cotton shirt so you can get a reasonable amount of wear from even the cheapest oils; in fact, it is not known yet whether the cheapest oils are not as good as the most expensive oils, but fit is known about.

In the United States the Society of Automotive Engineers have done a great deal of work in the investigating of lubricating oils and in the matter of fitness of oil have discovered there is a relationship between fitness of oil in the matter of viscosity at different times of the year, meaning different degrees of heat or cold. They have made elaborate tests and have presumed to set certain numbers of fitness opposite certain oils of definite viscosity. This has been known for several years but all oil companies have not adopted it to date. Take one much used imported oil which is designated as "A", "BB", and "EE", but curiously enough B is not heavier than A and E is lighter than A so there is no connection between them and nobody but the person selling knows what it means until you get used to the oil.

Another Company says "Light Oil" "Heavy" or "Extra Heavy" but these do not fit in with the A.B. and C. of the other Company and then others have "Heavy" "Light Heavy" and so forth, but the heavy of one Company is the light of another company so there is no relation. The Oil Companies have never got together. So far as fit is concerned it is affected by the time of year or the climate. The Society of Automotive Engineers classify this as S.A.E. 50, S.A.E. 10 and so forth. S.A.E. 10 is light and S.A.E. 50 is very heavy and these various numbers have been applied to the oils so they can be obtained and therefore it would be of great advantage to the buyer if every oil company would put on every container their own marks and in addition these numbers.

The first thought that occurred to the Committee was that it would be an excellent thing to compel by law to do that, but on second thought it might be a dangerous thing. Synthetic oils can be made with soap, molasses and so forth and duplicate the fitness and the trouble would be if required by law that the number be stamped on the container then the man offering this rubbish for sale could say this must be good because it has the official grade and stamp, neglecting to say that only applies to fitness and not quality, so the committee did not suggest that, but did suggest that all the oil companies might put that on and to-day it is being done so in a short time every container will have these S.A.E. numbers put on by the manufacturer. That is S.A.E. 10 will be for cold weather, 10 below and they will contract you get that fitness of oil in any brand, which will be a great advantage.

It is quite apparent to the modern engineers, that although little is known of the lubricating system of internal combustion engines, that the first thing is the oil must reach the bearing surface and you will realize it is better to have a poor oil which gets to the surface than an oil of high quality which does not get there, so the lubricating system is exceedingly important.

I would like to explain exactly how tractors and automobiles are lubricated. There are four methods by which oil is applied to the cylinders and pistons. I am saying nothing about crank shafts and bearings, because probably if in the pistons and cylinders it is satisfactory it will be satisfactory in the bearings. The professional engineers method of doing this and the method before tractors came into vogue was, every bearing had a little pipe of its own. The old International tractors used to have them and you could see the oil dripping into the tubes, with a little pump forcing it to the individual bearing. That is a perfect system but it distinctly is extravagant because the oil is only used once and then lost and it is a lot of trouble and people do not like to be put to the trouble of keeping in use all these little tubes. The crank case is filled with oil and churned up and splashed into the pistons and cylinders. With an engine turning at 600 to 1200 revolutions you can imagine the terrific amount of splashing going on and it has been discovered through putting on some pieces of plate glass, that there is a fine mist of oil going on all the time. Unfortunately this does not give always perfect lubrication.

Then there was the pressure system, pumping the oil by high pressure through the crank shaft and up through the connecting rods and through the wrist pin up the pistons and cylinders and another method is a combination between the splash and pressure system and there are four different methods by which internal combustion engines are lubricated but it is practically impossible to visually see what is happening in there so engineers have a rather remote idea of what is happening to make good lubrication.

Winter driving in Canada is a different proposition to anything met with in any other part of the world. Only last year an important official of an Oil Company when approached for advice on driving in Canada said these fellows will never run automobiles or tractors. They had better stay with their dog teams, but as you know, they are being run successfully here.

Some factors should be experimented with. How heavy an oil and of what viscosity should be used in the summer and how light in winter. Can lubricating oil be diluted with kerosene? Can oils be cleaned and used over again? Is, or is not the lubricating property of oils, whatever this may be, ever worn out or destroyed by use? What factors make oils gum in cold weather? If you have a crank case filled with oil that is gummed you will not get lubrication and will do serious damage to your engine. Would it be possible to add lubricating oil to fuel oil as is done with small engines on washing machines. That is an interesting piece of investigation. These engines in the main part are lubricated by adding some lubricating oil, and it is amazing how long they will last with that means of lubrication. Is that a wise thing to do with automobiles in winter to ensure some lubrication is getting to the cylinders? What deterioration in lubrication is caused by the dilution of the lubricating oil with the water and unburned gases and oils used for fuels? That is a factor which is not known, whether dilution does any harm has not been tackled except by this Committee.

Exactly what deterioration and wear is caused by dust, grit and dirt being taken in through the air, through the mixer and through carbon from the cylinders? How much help can be obtained

in this matter by the use of air filters and oil filters. Lots of automobiles to-day are not fitted with filters. Is there a cheap and practical method of filtration for farmers?

What is the relative value between imported expensive oil and cheap oils manufactured in Canada?

One reason for the high price of certain oils is they are imported. Often there is a situation where imported oil and domestic oil is made from the same crude but they sell at a different price because the imported oil has to bear the cost of handling.

What problems are caused by the dewaxing of oils. I spoke a moment ago about this gumming. In order to avoid gumming some oil companies made scientific research into the question and found it was caused by the amount of wax in the oil. Engineers used to think one of the properties was the quantity of wax but they discovered they could remove that, and they now argue if they remove the wax they can do away with gumming. This was done but there is another grave trouble. When they removed the wax they removed the water-proofing property. When you take gasoline and burn in the air you have two resultant products which are CO_2 and water. Sometimes with a piston that leaks it will escape into the crank case and condenses into water. If you have natural oil, not dewaxed oil, it sinks to the bottom, but when the oil is dewaxed the water-proofing properties of the oil have been removed and an emulsion takes place, and an emulsion does not lubricate. That probably explains the reason why tractors and automobiles which have had the piston refitted and rebored, after having gone for a short time seize, and it has been found this has always been the case where dewaxed oil has been used. That is a factor that wants careful investigating and looking into. Is it better to use a light dewaxed oil to avoid gumming in winter or a heavier oil not dewaxed, and mix the heavier oil with a definite percentage of kerosene. Kerosene makes a good lubricant itself but it is so volatile that a small amount of heat vaporizes it. The new Chevrolet car advises the use of very light oil in the winter and a 10% mixture of kerosene, the most radical recommendation ever yet made for lubricating oils. The Committee has found quite a number of people who do deliberately mix a definite amount of kerosene with the lubricating oil in order to be sure the oil will be sufficiently liquid at all temperatures to get to the bearing.

How hot should an engine be run to promote the best lubrication and the best economy in the use of fuel oils? When a driver of an engine says my engine is running nice and cool probably it is costing a lot of money. Probably to run exceedingly hot is better economy in fuel oil and lubricating oil.

How much of a cooling medium is the lubricating oil itself as well as the water?

These are some of the factors apart from the standardization of quality that are more or less unknown. Some of these, however, the Committee's plan of work, if adopted, will throw a good deal of light upon, and these factors mean much to the economy in operation to all people using automobiles and tractors.

The exact factor of quality is only partly known. One thing oil must have is viscosity such that in cold temperatures it will run, but that is tested by seeing at what temperature the oil will run and be liquid. Then it must be of such a nature that it reaches the pistons and cylinders and that it will not take fire. That is judged by the flash test.

Another matter is the amount of residue. Then there is the temperature co-efficient of viscosity, not only that resistance to friction but what is the resistance at different temperatures.

Then there is the matter of evaporation, and a new quality which is called oiliness which is something difficult to define. You can take water in your hand and say it is not oily, and take Olive oil and say it is very oily, but what effect it has is interesting oil engineers at present.

Another thing is resistance to oxidation. Oil being a combination of carbon and hydrogen when it is brought in contact with oxygen it probably oxidizes, and the effect it has is to wear them away. What effect that has on oil is not known but it is being looked into.

You will see the matter of quality is a complex thing, an important thing, and is along way from being as simple as was thought by the man who said to stamp the quality on the can, but the Committee hopes through this enquiry to discover something about these things.

In spite of many things unknown there are many things which are known, and the Committee is of the opinion that lot of things are known but not being made use of. The Committee recommend in the preliminary report that education matter should at once be issued and a speaker might be engaged to explain some of the elementary things already known to farmers and others at various meetings. In spite of the fact that much is not known about the inherent qualities of oils, still some things are known and a good deal of loss and damage is caused by lack of knowledge of some of these facts. Here are some of them:

1. No engine should be started unless certain oil is getting immediately to bearings. This requires the right viscosity or S.A.E. number at the right time of the year. I think myself that probably one of the greatest causes of damage done to-day is people starting automobiles and tractors without being certain oil is getting to all bearings. Many are run for an hour without lubrication. It requires changes of oil to get to the bearings. It requires the right S.A.E. number at that time of the year, fit of oil, heaviness or viscosity, or light and heavy, and must be changed during the course of the year to meet conditions. If you use too heavy an oil in winter it will simply gum and will not run to the bearings and in time they will get heated up and by that time a lot of damage may be done.

2. New piston rings or new pistons or reboring creates a new situation, which may require quite a different viscosity of oil. For instance in some tractors you will find three little pit-cocks and sometimes the instructions of the tractor people are to remove all oil down to a section of the pitcock and refill. The Committee is of the opinion it may be possible by removing the top of the oil and leaving some under you are leaving in water and it might be better to drain a certain amount from the bottom in which case you remove the water.

Continual turning of an engine in an effort to start seriously dilutes lubricating oil because in turning the gasoline and kerosene are going into the crank case. Whether that dilution is doing any harm we do not know but tests are being made to determine that.

It is most important that air strainers and oil filters must be kept in perfect working shape in order to avoid grit and dust. One school of oil engineers is of the opinion that the most damage is done, not through poor oil but through the corrosive effect of grit and dust.

Attempts should be made to filter used oils. It would pay all farmers, if possible, to keep the used oils pending investigations now taking place.

Particular attention should be paid to see that the buyer gets exactly the brand and kind of oil he pays for, kerosene or gasoline.

In winter perhaps better to drain off all oil each night, heat the same very hot before putting it back on a cold morning, and in addition some lubricating oil might be squirted on top of the pistons, engine turned a little and in addition some lubricating oil placed in kerosene or gasoline. These things are being done by a number of people but could be more widely done.

An engine should never be switched from gasoline to kerosene until the machine is quite hot. A lot of trouble is caused by lack of recognition of that.

Engines should not be driven too cold. Most farmers think that a cool engine is the best, but as a matter of fact probably quite the opposite is the case.

The use of a choke on cars and tractors has a good deal to do with the efficiency of an engine and the causing of moisture in the lubricating oil.

A very important thing is that the crank case should be thoroughly cleaned out.

Experiments might be made with different prices of oils to see if satisfaction could be obtained for less money. Pending more accurate knowledge of the value of different brands of oils one should deal with reputable companies in whom they can have full confidence.

When we sent out the Questionnaire we received interesting and valuable replies. We asked them to hold special meetings to discuss this matter and most of these U.F.A. Locals did so. Apparently almost every brand and make of oil is found to be here and there both satisfactory and unsatisfactory. That is a matter of psychology and depends on the ability and salesmanship of a particular Company in a particular locality.

It is a very curious thing to find the satisfaction of the users of oil is in proportion to the price; the higher the price the better they think it. Probably this is only psychological, because most seem to object to the high price. Some imported oils are known to be made from exactly the same stock as Canadian manufactured oils that are sold at a lower price. Complaints are made of water in kerosene and gasoline, and complaints are made of lubricating oils that they cost too much, that they do not last long enough, that thick oils become thin and thin oils become thick, that some tractors have been seriously harmed at times which has been attributed to faulty oils.

Apparently not a great deal is known of the proper methods in which oils should be used and exactly the function they perform. There should be a good field for education here. U.F.A. Locals should be a good means or instrument for assisting future enquiries of this kind and enquiries of other kinds that have to do with agriculture and things the farmer uses.

CONCLUSION

The Committee is of the opinion that a great deal remains to be profitably learned about lubrication.

That an investigation into these facts will be a good investment, inasmuch as factors may be discovered that will mean large savings to farmers and automobile operators, in the way of the use of less or cheaper oils and in the way of less wear and tear and better satisfaction from tractors and automobiles.

The Committee, in its preliminary report therefore recommends that the investigation be continued for at least a year from January 1st, last.

The sum of \$1,100 was expended from September 6 to December 31, 1929, and the Committee estimates that the cost of the investigation for another year would be about \$8,900 although it has to admit that to some extent it is groping in the dark and may almost at any time discover factors that might lead it to recommend the modification or expansion of its programme. It therefore might be well to bear in mind that some elasticity in its work should be allowed the Committee.

It is refreshing to find that the Oil Companies and tractor users, that other Provinces, and the Dominion Government, are most sympathetically interested in this enquiry, which unquestionably will eventually lead to national co-operation when the time is ripe.

The Committee have received the utmost consideration and help from Cabinet Ministers, particularly from the Hon. Mr. Reid, who has taken a particular interest in the work.

A special laboratory has been fitted up at the School of Technology for this work alone. An able chemist has been engaged and it is felt that if it is desired, when this enquiry is over, that this laboratory will furnish a fine permanent testing station.

As Chairman of the Committee I would like to use this opportunity of saying that the Government is fortunate in having enlisted the interest and assistance in its work of the two other members of the Committee, Mr. Stansfield of the University of Alberta, and Mr. James Fowler, Vice-Principal of the Institute of Technology, Calgary. Mr. Hedley, in charge of practical tractor work at the Institute of Technology, is also rendering invaluable service in the work he is doing in supervising the running trials.

Chairman: I am sure Major Strange has covered a wide field. Are there any members would like some further information on particular points.

Mr. Galbraith: I presume the law lays down gas is to be sold by the gallon but we buy it by weight. Who determines that weight? I know they have changed it from time to time.

Major Strange: It is a matter of custom and arrangement between the companies. As I said before, as far as the specific gravity is concerned it does not make much difference. The weight per gallon varies with the specific gravity. You are getting more pounds to the gallon now than you used to get when you bought 72 Beaume'.

Q. But have they that in their own hands to determine?
A. There are great difficulties in accurately determining. Certainly there is a little slack there if it amounts to anything.

Q. I know a man who paid by the weight and sold by the gallon and he had to lose. He said the Government made him measure it out and he thought they should be made to measure it in.

A. If the jobber buys by weight and sells by the gallon he would gain in the summer time and lose in the winter.

Q. Mr. Nelson Smith: I have had several enquiries with respect to that question. I had enquiries from certain users of large quantities of gasoline and I submitted the enquiry to Mr. Stansfield. This man had gotten into an argument with respect to the volume of fuel oil he was getting. He was buying by weight. I think your Committee could give that matter consideration because there is a discrepancy, particularly with respect to the automobile users because they buy from the Filling Station and that effects the dealer.

A. All professional engineers buy by weight because weight is the real measure of what you buy. Take the analogy of a loaf of bread. You buy so many pounds of bread. No matter how expanded you get the same amount of value and it is the same with oil and gasoline; it is a matter of temperature. What happens is this. The oil is measured, the temperature taken and corrections made of temperature to volume which gives you weight. Supposing you had a drum containing 48 gallons when full. Let us assume that, and then we have something upon which to work. You take the temperature of that container and with the table of correction find exactly the amount of weight to buy. Volume changes but weight does not. A pound of oil in summer is of greater volume than a pound in winter, but in a pound of oil you have the same heating qualities.

Q. Mr. Enzeneaur: What is the standard weight of the general quality of gasoline. You have a fair idea of what is meant by gasoline. What is the correct way of averaging the gasoline?

A. Major Strange: If your gasoline is of 61 Beaume at a temperature of 75 degrees there is a definite weight for that.

Q. What is it?

A. I cannot tell you off hand. It is very complicated and varies with every degree of temperature and every degree Beaume. You would have to take with the hydrometer the specific gravity of oil, then the temperature of it and using these two co-efficients--

Q. I am a prospective purchaser of gasoline. You have collected samples. How many pounds is it reasonable for me to expect? What have I a right to expect in the way of pounds per gallon?

A. I would have to know the specific gravity of the oil the moment it was delivered to you and the temperature of the day.

Q. Is this Beaume test or specific gravity changing from day to day.

A. It is different with all makes.

Q. Take the oil or gasoline that has a specific gravity a certain number to-day, and do that again to-morrow is it quite likely to be different?

A. Yes, within limits. For instance the gasoline surveys made by the Department of Mines show that Beaume varies from 57 to 64° with different makes, and the same goods at different times of the year.

Q. Mr. Brown: Is it not a fact the oil companies establish a certain weight of 6 lbs. and a fraction for gasoline and the cost of that is uniform throughout the year?

A. That is not true.

Q. Mr. McCool: They sell it from the Agents' point of view that way.

Q. Mr. Enzeneaur: Retail distribution; it is sold on the basis of weight.

Major Strange: You cannot say that people can agree this weighs 1 1/2 pounds when I find it only weighs a pound. You may make that agreement but it does not mean anything, but say roughly

then the average it will weigh in the summer is such a figure and in the winter is such a figure, but you have to know the specific gravity of the gasoline and the temperature of the container in which the gasoline is put.

Q. Mr. Enzeneaur: You are viewing this from the scientific angle. I am viewing it from the practical angle. Your Committee has been gathering information. Now you are quite aware the Companies have been selling gasoline to the distributors by weight. That is a common practice carried on in the gasoline business and the number of pounds they allow to the gallon I would like to know. What are these people being allowed per gallon?

Major Strange: Perhaps you had better put it this way: What is the average weight throughout the year.

Q. Mr. Enzeneaur: What do they allow the dealers?

A. I cannot tell you that. We have only got started, but what happens there if the distributing company allows distribution at one weight is they average it all up, but if you want to be strictly correct you have got to know the temperature, and the temperature of the container. One can say looking over five years, Imperial Oil gasoline varied from 57 to 64 and therefore the average is 60, and you can say the average temperature from the 1st of May to the 1st of October is 65°, and in winter time you can average it up, but you get tremendous variations from day to day, and if a man wanted to buy large quantities he would have to take these two things, but you could average it and if you are buying the year round you will gain in summer and lose in winter. But, supposing oils drop in specific gravity next year? Since 1911 they have dropped from 72 to 60. Suppose they drop to 50 all your averages would be of no value. If you set an arbitrary figure you have to set an average.

Q. Mr. Frame: The drums of the Imperial Oil Company that we have in the North, they have gross weight and net weight on the top of the drums. It does not matter when they are sold the wagon is put on the set of scales and weighed that amount, say 44 gallons in each drum. They must have an average?

Major Strange: That is perfectly true. Usually the Company selling the oil at that time of the year knows the specific gravity.

Mr. Frame: It is the same winter and summer.

Major Strange: It is not correct because in winter they put out a higher specific gravity called winter gasoline.

Mr. Frame: I saw a contractor get 400 gallons, that is weight you get, and that is 44 gallons. That is stamped on it.

Major Strange: Summer and winter it is the same?

A. Yes. They are put on the scale there and it is pumped in there and when that turns the scale you take it off.

Major Strange: Unquestionably what is happening, in order to avoid intricate calculations they have averaged it up.

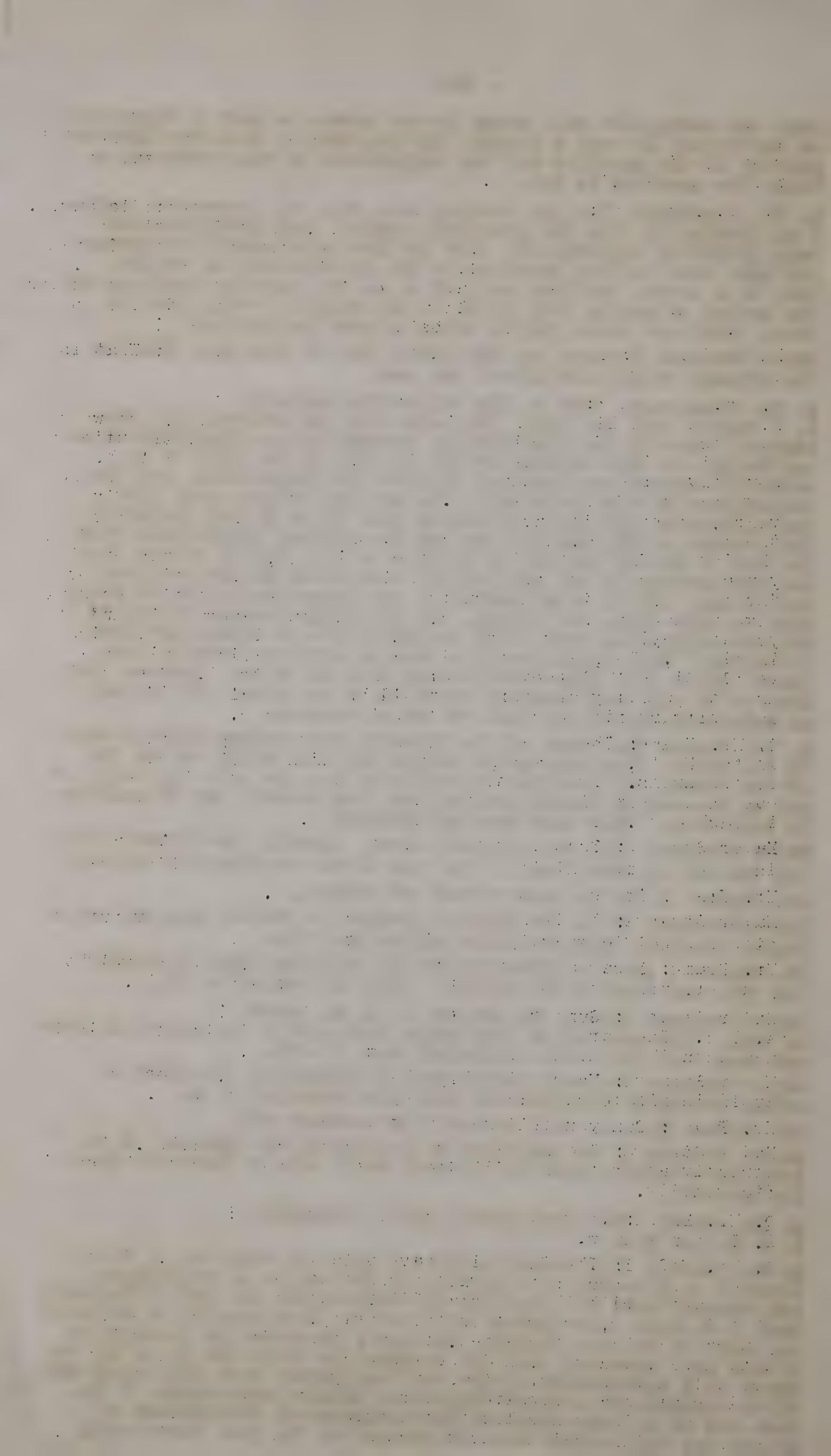
Mr. Frame: Can you tell me what that average is?

Major Strange: I can tell you by looking up the tables. To be strictly accurate each Oil Company would have to have the specific gravity.

Q. Mr. Brown: They have agreed upon a standard?

A. I do not know.

Q. Mr. McCool: The Companies have a table of weights. I think about 8 or 9 pounds to a gallon and that table of weights has not changed with the Imperial Oil Company for the last five years; that I do know, and whether the gravity, or viscosity or whatever you call it has not changed, the agent receives his gasoline in a tank car, measured, and the temperature taken and it is all reduced to a temperature of 60° and they figure from that basis and he is charged and credited according to the temperature of the tank and he in turn sells to the purchaser or distributor by weight and that weight has not changed in the last five years.



Major Strange: They are adopting an average. The committee can look into it and see if it is of any consequence. One might adopt an average that is simple and workable, yet on the other hand if decided changes have taken place in specific gravity that might be considerable.

Mr. Frame: You cannot strike an average as the most is used in summer, not in winter. You are getting most of it at one time. They should have a summer weight and a winter weight, is that not right?

Major Strange: If they have been using one weight for winter and for summer for five years it is an average because these factors vary during the summer and winter.

Mr. Frame: My point is that they should be put right.

Major Strange: It can be looked into. The only way to get that right is to determine the temperature and get it accurate. Whether that would be worth while is a question but we can look into it.

Q. Mr. Galbraith: I was informed by one of the Managers that there was over a foot of water in one of the big containers and I thought probably it was put there to make a place for dirt to accumulate in the large storage tanks.

Major Strange: That would not make very much difference provided the oil is taken off above the water level, and that is exactly what happens. I know of one instance with which I was connected where we used to maintain two feet of water in the oil tanks in order to put out fire if it was needed but it never got mixed with the oil because we drew it off two feet above.

Mr. Enzeneaur: Is it possible for a barrel partly full to have water brought in through condensation of the water in the air out on the farm. Is it possible for that to accumulate water. It is a well recognized factor that grain will take weight from the atmosphere. Will gasoline do the same?

Major Strange: Theoretically yes, but to such an amount as would be negligible when you figure it has got to get into a two inch hole.

Mr. Enzeneaur: Is it quite possible for a gallon to get in?
A. I do not think it possible for a pound.

Q. With an individual belonging to such a firm as you speak of would you class the firm as reputable?

A. We are dealing with the factor of human weakness. I meant a manufacturer of reputation who is turning out of his factory a reputable product. From the factory comes the distributor, from the distributor the retailer, and from the retailer there is the man driving a tank wagon to the farm. Dealing with men of progressively lower salaries there is a bigger strain on character all the way down.

Mr. Enzeneaur: You emphasized the importance of dealing with a reputable firm. In practise out in the country would you say it is more important that I deal with a firm that is reputable or the man who is reputable that makes the trip to the farm?

Major Strange: I had in mind dealing with a firm who makes a reputable product. You have to take a chance but one would imagine a firm that has got a lot of money out would see to it that it employed men which would handle the material properly and well. I do not say their product is better but because they have a large amount invested they would perform more research and take more care than the man who comes with a bottle of oil and you do not know where he comes from.

Mr. Enzeneaur: Is the only method of determining quality by putting into the burner. Is there not a scientific method of determining?

Major Strange: Within reasonable limits that is true. Take any oils of a national and international reputation and the only possible way to tell if one is better than the other is to put it in your tractor, run it and see how you like it. Here is what might be done at the Laboratory. If you send in oil and say I have been recommended this oil for running in the winter. Do you consider that a fit oil to run at 15 below zero. That is fit and now the viscosity is known. You would not run S.A.E. 40 to run in winter. Anyone will tell you after testing it that is a wrong oil to use. But here is what can be done. Supposing some fellow mixes molasses, soap and kerosene and sells it as lubricating oil, they can tell that instantly, but between the synthetic mixtures and oil that is suitable there are many ranges in between that might come within the range fit by testing for sulphur, with the flash test and so forth, and yet it might not be a good oil for your purpose.

Q. Mr. Walker: Why does the Imperial Oil say Mobiloil is a better quality than certain other kinds of oil. They put out Marvelube and they must think it an inferior oil, but how do they know that Marvelube is not as good as Mobiloil?

Major Strange: They do not say that. They may make more profit out of one than the other. It is made of crude oil which they may buy a little cheaper but write any reputable oil company and ask them which is the best oil for you to use of the oils they put out. They will tell you they are all good for the price. You will get value for the money you are prepared to pay.

Mr. Walker: But cannot the Laboratory put it to the test and then use it for a certain time until you get a certain test?

Major Strange: Because every one shows the same results except for thickness of the oil. You can buy Marvelube, light, heavy, extra heavy or Polarine, or Moliloil A or B or Arctic, and all the difference there is is different viscosity and all you will have will be S.A.E. numbers, Autolene S.A.E. 20 or Polarine S.A.E. 20 and as far as I know to-day within the test that they were submitted to, the probability is that all will respond in the same way. The reason of our enquiry at the Laboratory is to determine if we can find some factors, by the use of different methods.

Q. Mr. Cook: Can you tell us the different basis of refining?

Major Strange: Crude Oils come from different fields, Pennsylvania, Texas, Oklahoma, Wainwright, and perhaps some day from the tar sand oils. They are all mixtures of hydrogen and carbon. Pennsylvania oils have a base of paraffin which can be burned up and the Pennsylvania oils were exceedingly popular for the reason they claim all is burned up. The oils used for lubricating purposes were next California and Texas oils. They had an asphalt base, a kind of carbon. Then there are some oils with a base between paraffin and asphalt technically called naphthalene, but of late years manufacturing methods are such that as far as base is concerned it practically makes no difference.

Mr. Walker: If you come to a filling station and you put in some oil manufactured from an asphalt base on top of another oil they claim there is injury results.

Major Strange: As far as a mixture of asphalt base and paraffin base is concerned, you will probably get complications with any mixture.

Mr. Walker: Is it not correct that some manufacturers of certain makes of tractors are very definite in saying you should be careful not to allow any lubricating oil to get into the fuel oil?

A. Major Strange: You are correct, but the whole art of lubrication and of the qualities which are needed in oil are to-day so little known the probability is that when they do become known 9/10ths of the instructions put out by the tractor men will be

found to be entirely wrong. When you discover that a 1 1/2 H.P. engine on a washing machine is lubricated by lubricating oil and gasoline and will run for year after year it makes you think.

Q. Mr. Brown: How great a factor is freight in the price of our lubricating oil?

Major Strange: We have not got around to that question yet.

Mr. Brown: It is well known we are in the heart of the producing area and is it not a fact that fuel oil is just as expensive in Turner Valley as it is in any other part of the Dominion?

A. For the same curious reason that a loaf of bread made from Alberta wheat costs more in Calgary than in London. One is getting down to the fundamentals of the evolution of society.

Q. You stated oil come in, on account of freight sold at a higher price?

A. Probably the reason for that is crude oils brought in here by the manufacturer to be manufactured into lubricating oils come in tank cars and also come from nearby fields while the factory in the United States may be a further distance away than the refineries are in Canada so the factories in Canada bring in crude Oil from the States and the freight is higher, if brought in drums the expense would be more.

Q. Mr. Nelson Smith: Have you determined as to whether the difference in price of fuel oils comes within your purview?

A. Major Strange: That is not within the duty of the committee. We did take advantage of the questionnaire. I will read you the Questionnaire:

1. Names of Companies selling fuel and lubricating oils in your district.
2. List of products, with brand names, sold by such companies in your district.
3. Experiences of members of your Locals with these products and their use in automobiles and tractors, giving particular details of any trouble experienced.
4. Any other information that will be of assistance to the Committee in their enquiry.

Mr. Smith: The Edmonton Board of Trade and the Automobile Association are very much interested in this and I suggest you co-operate with these Associations. The Board of Trade find that the wholesale price to the dealer is 28 1/2 per gallon with tax paid in Calgary, and the wholesale price with taxes paid in Edmonton is 32 1/2 and there is a differential of 1.6, and the wholesale price of the same gasoline in Winnipeg is 26 1/2 cents per gallon or 2 cents less than in Calgary or 6 cents less than in Edmonton. They are further away from the gas producing field, although the volume is small here in connection with the total amount used.

I think these are things your committee should investigate. A private individual cannot get that information, the Board of Trade cannot get that information, as if they try, such a volume of figures is presented to them that no one but an expert can decide. They are not appointed by a recognized body to get this information, and I think your committee would do well to give that matter consideration.

Major Strange: It does not at the moment come within the work of our committee but if the Government ask us to take up that work we can say whether we or someone else would be fitted to do it.

Mr. Farquharson: I introduced this motion into the Legislature and left that feature out of it because I do not think that this committee is of the right type to investigate that, not the right people to make an investigation as to price and if we wish to get the information asked for by Mr. Smith we should ask the Government to get it for us, but I was of the opinion at the time I moved this resolution that this committee would have all they

could do to get the information asked for. I think the question will indicate, Major Strange, that there was some need for this investigation. In regard to S.A.E. tests these are only relative to viscosity I suppose in that they take a range of temperatures -- do you know what these temperatures are?

Major Strange: I cannot tell you off hand, but we have them all on file. It was first set up by the Society of Automotive Engineers and these tests are adopted to-day by all Automobile Companies. We can give them to you.

Mr. Milhalchan: Is there not some test of the oil in the tractor that could be used as well as the scientific methods?

Major Strange: Running tests in tractors at the School of Technology under controlled conditions are made to determine the amount of dilution, the amount of wear on pistons, cylinders and rings. After all these are the practical things one is interested in, and these are being done and being recommended by the Committee. We have recommended checking these running tests under controlled conditions in the farmers fields. These are practical tests.

Mr. Proudfoot: I have been told there is a certain device available now by which two discs move together against each other, varying degrees of pressure can be applied to these discs, and there is also a thermometer by which to measure temperature. I take it the system will vary with the nature of the oil and in that way you can test the use of the oil. Are oils being tested in that way.

Major Strange: That is somewhat along the lines of an apparatus designed by the British American Oils called a corsistometer, but these machines cost \$2,500 and I believe there are only one or two in existence. We are using all standard apparatus.

Mr. Proudfoot: It seems a practical way of determining that thing so hard to get at, the matter of quality.

Mr. Farquharson: You have made certain tests of oil. Can you tell us what factors you have taken into consideration. I presume you have made tests in the Laboratory.

Major Strange: For viscosity at 100°, at 130 and 210. We are testing Flash Point, Fire Point; we are testing pour point down to 20° Fah. and carbon residue. That is on lubricating oil. In addition we are making definite and practical running tests.

Mr. Farquharson: Have you made any of these tests yet? A. They have been going on for two months and we hope to run all summer. Running tests under individual methods, with different oils to determine the amount of dilution, the amount of wear on the pistons and cylinders and the amount of disappearance of oil.

Mr. Farquharson: I presume these will cover different makes of oil. Would these tests be available to this committee.

Major Strange: It would be a question whether the Government would care to publish, giving names of brands and so forth. It has never been the policy of the Dominion Government to do that. If we could be definitely certain that the tests are final and definite, but if we were to discover after a couple of years that this was not correct it might do a grave injustice. The policy of the Deminion Government has been not to name the companies and the brands but to give them arbitrary designations such as No.1, 2 and 3.

Mr. McKeen: Of what good is that to the general public? What I want to know from actual tests is what you have decided, whether rightly or wrongly what you consider to be the best brands of oils.

Major Strange: I am afraid from the little known about oils we can tell something at the end of the year but I am afraid if we conducted the work for ten years we would hesitate to say one brand of oil is better than another except under some definite controlled factor. This would be a thing for the Government to decide but

in my opinion it would be highly dangerous to say too much until it has been subjected to a lot of tests for a good length of time.

Mr. McKeen: This is not going to be of much benefit to the average consumer short of four or five years.

Major Strange: A great many things may be discovered quite apart from the brand of oil. There may be no difference in the brand of oils but a tremendous difference in methods of management that will be of infinitely more importance than this oil or that oil.

Mr. Washburn: Would you say it might be possible to get as good service out of a 50 cents as a \$2.00 oil?

Major Strange: This committee is actually making these tests. My advice is this, as far as we know at the present time; find the type of oil you believe gives you satisfactory service from a reputable company and stay with it.

Mr. McKeen: How do we know when it gives satisfactory service?

Major Strange: I do not think there is a single oil on the market, if you use the right S.A.E. number that will not give you fair service.

Mr. Nelson Smith: As seconder of the resolution that brought the committee into being I want to say we appreciate the work they have done and also the pleasure of listening to this report. I think there is a great variation in the prices for oils and I think it is imperative something should be done in that direction. I would therefore move:

"That this committee recommend to the consideration of the Government the appointing of a Committee or Commission, evidence to be taken under The Public Inquiries Act, for the purpose of making a complete inquiry on the price of gas and fuel and lubricating oils in Alberta".

As there was some dissatisfaction as to the exact wording of the resolution, the matter was left over until the meeting of the Committee on Monday the 17th instant, when a resolution would be presented to be voted upon.

The Chairman, Mr. Cameron, thanks Major Strange for his address, and announced that the Committee would meet for further discussion of the matter under consideration and to hear Dr. Robert Newton, on Monday morning, March 17th.

On motion of Mr. McLaughlin the committee adjourned.

Certified a transcript of my shorthand notes.

Emma W. R. Jones,
Reporter,
305 McLeod Building, Edmonton.



